

CHAPTER 19

SURFACING / RESURFACING

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INTRODUCTION

Purpose of chapter: To provide guidance for design and direction for standards related to surfacing and resurfacing projects. This chapter provides standards and guidance, however engineering judgement and references like AASHTO (Green Book) and FHWA should always be used in design.

See Chapter 18 – Plans Assembly for detailed examples of Surfacing Plans.

DEFINITIONS

Approach Slab – intended to provide a smooth transition between a roadway pavement and a bridge. The slab spans the embankment directly behind the abutment and eases the transition between the abutment and embankment.

Asphalt (Asphalt Binder or Asphalt Cement) - a dark brown to black cementitious material in which the predominating constituents are bitumens which occur in nature or are obtained in petroleum processing. Asphalt is a constituent in varying proportions of most crude petroleum.

Asphalt Binder - Asphalt cement that is classified according to the Standard Specification for Performance Graded Asphalt Binder, AASHTO Designation MP1. It can be either unmodified or modified asphalt cement, as long as it complies with the specifications.

Asphalt Concrete - a high quality, thoroughly controlled mixture of asphalt binder and high-quality aggregate, which can be thoroughly compacted into a uniformly dense mass.

Asphalt Emulsion – an emulsion of asphalt binder and water that contains a small amount of an emulsifying agent. Emulsified asphalt droplets may be of either the anionic (negative charge), cationic (positive charge) or nonionic (neutral).

Asphalt Prime Coat - an application of asphalt primer to an absorbent surface. It is used to prepare an untreated base for an asphalt surface. The prime penetrates or is mixed into the surface of the base and plugs the voids, hardens the top and helps bind it to the overlying asphalt course.

Asphalt Tack Coat - a relatively thin application of asphalt binder applied to an existing asphalt concrete or PCC surface at a prescribed rate. Asphalt emulsion diluted with water is the preferred type. It is used to form a bond between an existing surface and the overlying course.

Base Course – the layer or layers of specified select aggregate material placed on a subbase or a subgrade to support a surface course. Base Course requires compaction to a specified density per Section 260 of the *SDDOT Standard Specifications for Roads and Bridges*.

Blotting Sand for Prime – sand applied immediately following the application of a cut-back asphalt on a granular surface to prevent the transfer of the cut-back asphalt from the surface.

Bulk Specific Gravity – the ratio of the weight of a given volume of aggregate, including the permeable and impermeable voids in the particles, to the weight of an equal volume of water.

Cold Milling – Asphalt Concrete Pavement – using a self-propelled unit with a cutting head equipped with carbide-tipped tools for the pulverization and removal of layers of asphalt materials from pavements. This is an effective method for removing distresses in the top of an asphalt concrete pavement, providing a smoother surface by removing vertical deformations, reestablishing or setting the required cross slope, and improving surface friction.

CRCP – Continuously Reinforced Concrete Pavement – a type of concrete pavement that does not require any transverse contraction joints. CRCP contains a significant amount of longitudinal reinforcement influencing the development of transverse cracks and holding the cracks tightly together. Transverse reinforcement is also used to support longitudinal steel during construction.

Cutback Asphalt - asphalt cement which has been liquefied by blending with a petroleum solvent (also called a diluent), to form one of the following cutback asphalts. Upon exposure to atmospheric conditions the solvents evaporate, leaving the asphalt cement to perform its function.

Diamond Grinding – Concrete Pavement – an effective method for removing minor joint faulting and other surface irregularities to restore a smooth riding surface and increase pavement surface friction.

Digouts – the removal and disposal of unstable material below an existing surface on which surfacing material is to be placed. Digouts are utilized on interim surfacing and on asphalt concrete resurfacing projects.

Dowel Bar – short, smooth steel bars that provide a mechanical connection between slabs without restricting horizontal joint movement. Dowel bars are placed in concrete pavement across transverse joints to provide vertical support and transfer load across joints. Dowel bars reduce the potential for faulting, pumping, and corner breaks in jointed concrete pavements.

Fog Seal – an application of asphalt emulsion used on an asphalt surface treatment to seal the surface and embed loose chips. Sand for Fog Seal can be placed at locations determined in the field by the Engineer but is not required for the entire length of the Fog Seal.

Flush Seal – an application of asphalt emulsion used on an asphalt concrete surface to seal the microcracks in the pavement. Sand for Flush Seal is applied after the asphalt emulsion is placed.

Gravel Cushion – the layer or layers of specified select aggregate material placed on a subbase or a subgrade to support a surface course. Gravel Cushion is typically used below PCCP. Gravel Cushion does not require compaction to a specified density, per Section 260 of the *SDDOT Standard Specifications for Roads and Bridges*.

Gravel Surfacing – the layer or layers of specified select aggregate material placed over the base and used as the final surface course. Gravel Surfacing does not require compaction to a specified density, per Section 260 of the *SDDOT Standard Specifications for Roads and Bridges*.

Haul – bid items containing the word ‘haul’ are used only when forcing the Contractor to haul material to a specific location set up in the plans (typically State Furnished site).

Hydrated Lime – additive for asphalt concrete pavements that can help resist rutting and fracture growth at low temperatures, reduce age hardening, stripping, raveling and improve the moisture resistance and durability.

JPCP – Jointed Plain Concrete Pavement – concrete pavements that contain enough joints to control the location of all the expected natural cracks, without reinforcement between the transverse joints. All necessary cracking occurs at joints and not elsewhere in the slabs. The pavement may or may not contain dowel bars across the transverse joints. JPCP is also considered Nonreinforced PCC Pavement, as this is the bid item used and the majority of the concrete pavement installed for the SDDOT.

JRCP – Jointed Reinforced Concrete Pavement – concrete pavements that contain reinforcement between the transverse joints. Designers intentionally increase the joint spacing and include reinforcing steel to hold together mid-panel cracks. The pavement may or may not contain dowel bars across the transverse joints.

LA Abrasion Loss – a calculated abrasion value to gauge the abrasion resistance of an aggregate sample. The less loss occurs, the tougher an aggregate is, therefore the lower the number, the harder the material.

Leveling Lift – initial asphalt concrete lifts placed directly on to existing pavement to fill low spots and surface voids in the pavement. These lifts are typically less than or equal to one inch.

Micro-Milling - Asphalt Concrete Pavement – uses a milling head with about three times more teeth than a conventional milling head to remove a thin layer of existing pavement surface. This produces a more uniform surface compared to conventional cold milling.

Micro-Surfacing – consists of a mixture of latex-modified emulsified asphalt, mineral aggregate, mineral filler, water, and additives. Micro-surfacing material is mixed in specialized, compartmented, self-powered trucks and placed on the pavement using an augured screed box. This is effective at correcting or inhibiting raveling and oxidation of the pavement surface, reducing rutting issues, improving surface friction, sealing the pavement surface, and filling minor surface irregularities.

Portland Cement Concrete Pavement (PCCP) – Portland Cement Concrete (PCC) pavement, or rigid pavement, refers to the rigid concrete layer of the pavement structure that is in direct contact with the traffic. Typical concrete is composed of coarse aggregate (crushed stone and gravel), fine aggregate such as sand, portland cement and water.

Processed Subgrade Topping – a blend of Recycled Concrete Aggregate (RCA) and excavated soil typically compacted in the upper one to two feet of the subgrade and directly below the surfacing section.

Note: Granular Material may also be incorporated into the RCA/soil blend.

RAP (Reclaimed Asphalt Concrete Pavement) – Excavated asphalt pavement that has been pulverized, usually by milling, and is used like an aggregate in the recycling of asphalt pavements.

Residual Asphalt – the remaining asphalt after an emulsion has set, typically 57-70 percent of the undiluted emulsion.

Select Subgrade Topping – naturally occurring selected material compacted in the upper one to two feet of the subgrade and directly below the surfacing section.

Sleeper Slab – a reinforced concrete block below and supporting the end of the concrete approach slab at the approach roadway end.

Spot Leveling and Repair – spot locations determined by the Engineer during construction that are in need of additional asphalt concrete for leveling or repair. Typically, due to a bump or dip in the road, or if the existing surface condition is very poor as compared to the adjacent roadway.

Subbase – the layer or layers of specified or selected material of designated thickness placed on a subgrade to support a base course or surface course. Subbase requires compaction to a specified density per Section 260 of the *SDDOT Standard Specifications for Roads and Bridges*.

Subgrade – the soil prepared to support a pavement structure or a pavement system. It is the foundation of the pavement structure.

Tack Coat Break – the moment when water separates enough from the asphalt showing a color change from brown to black. Breaking is the separation of the water from the asphalt. After breaking and curing, the asphalt residue has the adhesion, durability, and water-resistance properties of the original base asphalt.

Tack Coat Set – when all the water has evaporated, leaving only the residual asphalt.

Terminal Anchor – used in continuously reinforced concrete pavement (CRCP) to transition to another pavement type or a bridge structure. Their function is to isolate adjacent pavement types or structures and anchor the CRCP so that excessive movement does not occur.

Tie Bar – deformed, epoxy coated steel bars, typically placed mid-depth across longitudinal joints or between an edge joint and a curb or shoulder. They are designed to prevent lane separation and differential deflection and reduce transverse cracks by holding the faces of abutting slabs in contact.

Tining – a macrotexture applied to concrete pavement to provide drainage channels for water along with additional skid resistance. Plain Jointed concrete pavement can be either longitudinally or transversely tined.

EXISTING MATERIALS – REMOVALS AND SALVAGING

This section is intended to clarify methods and standards when removing or salvaging existing materials.

Bid Item Clarifications

Planing PCC Pavement – used when removing concrete to a set depth. This is typically done with a milling machine and is not for profile smoothness. This item is paid for at the contract unit price per square yard.

Remove Concrete Pavement – used when removing and not salvaging PCC pavement. This quantity will not be included in the Excavation or Unclassified Excavation quantities and is typically measured and paid for by the SY for ease of measurement in the field.

Remove Asphalt Concrete Pavement – used when removing and not salvaging asphalt concrete pavement, and when not concerned with both the method (equipment) of removal and integrity of the removed material. This material is not required to be reused on the job. Contractor may have the option to dispose of or reuse the material if the Contractor desires to. Material will need to meet specifications for the material of use and be approved by the Engineer. If no asphalt concrete mix material is to be reused on the project, this bid item should be used. This quantity will not be included in the Excavation or Unclassified Excavation quantities and is typically measured and paid for by the SY for ease of measurement in the field.

Cold Milling Asphalt Concrete – used when removing a portion of the existing asphalt concrete surfacing when the method (equipment) used for removal is of concern. Method (equipment) of removal and resulting surface condition resulting after removal is specified by Section 332. Typically used to re-profile the surface or to remove surface deficiencies. All or a portion of the removed material will likely be used as RAP. This item is paid for at the contract unit price per square yard or as indicated in the plans.

- Related Bid Item: Cold Milling Asphalt Concrete and Placing Cold Milled Material –This item is paid for at the contract unit price per square yard or as indicated in the plans.

Salvage Asphalt Mix Material – used when removing all or a portion of the existing asphalt concrete surfacing when not concerned with method (equipment) used for removal but preserving the integrity of the material and avoiding contamination with underlying material is of concern. Integrity of material removed is specified by Section 270. Only used when combined with another bid item (i.e., Blend and Stockpile; Blend, Haul, and Stockpile; Haul and Stockpile; etc. or if by plan note the material is to be used as RAP or blended with other granular materials). If a portion of the existing asphalt concrete surfacing will be reused on the job, the Salvage Asphalt Mix Material bid item can be used to remove all the material. May also be used in conjunction with Cold Milling Asphalt Concrete. This item is paid for at the contract unit price per ton.

Salvaged Materials - See Section 884 of the *SDDOT Standard Specifications for Roads and Bridges* for gradation requirements of each of the following bid items:

- Subbase, Salvaged
- Base Course, Salvaged
- Base Course, Salvaged Asphalt Mix
- Gravel Cushion, Salvaged
- Gravel Surfacing, Salvaged
- Salvage and Stockpile Asphalt Mix Material
- Salvage and Stockpile Asphalt Mix and Granular Base Material
- Salvage and Stockpile Granular Material

Sawing Pavements – when a project requires sawing, the standard sawing note and table in Section F – Surfacing Notes should be used and adjusted accordingly.

For projects that include leaving existing lanes in place and adding width to the existing section (shoulder widening, adding turn lanes, etc.):

- Payment to provide a clean, vertical face cut will be made through either of the following bid items:
 - Saw Joint in Asphalt Concrete
 - Saw Joint in PCC Pavement
- If both pavement types are in place, the thicker of the pavement types (typically PCC) will determine the sawing bid item used
- These bid items are used if the project is salvaging, removing and/or disposing the existing pavement
- The operation used to provide the cut (saw cut, grinding, etc.) does not change the bid item

Excavation and Unclassified Excavation Clarifications

- When removing and NOT salvaging base or subbase material: this quantity WILL be included in the Unclassified Excavation quantity.
- When salvaging pavement and/or base/subbase material: this quantity will NOT be included in the Excavation quantity but WILL be included in the Unclassified Excavation quantity for the work to remove the material.
- The locations and extent of digout areas (Unclassified Excavation, Digouts) will be determined in the field by the Engineer. The backfilling material for the digouts will be Asphalt Concrete (asphalt concrete type will match mainline mix or in some cases may be Asphalt Concrete Composite) and Base Course or Base Course, Salvaged. The depth of the asphalt concrete will match the in-place thickness. The digouts will be extended to the shoulder and backfilled with granular material that will daylight to the inslope to allow water to escape the subsurface.

Full Depth Reclamation (FDR)

- FDR consists of processing and blending the existing, in-place asphalt concrete and granular base material (6"-12") and placing, watering, shaping, and compacting the material to the typical section. This reclaimed material will be used to construct a new base section, a new pavement structure will need to be placed back on top.
- FDR can also be performed on the shoulders to break up the in-place material before they are reshaped or resurfaced. Typical depth of an FDR on the shoulder is 4"-6". When this work is being specified, use bid item Full Depth Reclamation, Shoulder.
- Leave at least 2" of base material above the top of subgrade (will depend on location & existing materials). The 2" of in-place base material is excluded from the FDR to prevent contamination of subgrade soil into the base section.
- When completing an FDR, the final blend must contain at least 50% base material & at most 50% asphalt concrete millings.
- Reference Section 280 of the *SDDOT Standard Specifications for Roads and Bridges* for detailed standards on materials and construction requirements.
- FDR will be paid for at the contract price per square yard inclusive of all costs for processing, blending, placing, shaping, compacting, equipment, test strips, labor, and incidentals necessary to satisfactorily complete the work.

Cold In Place Recycling (CIR)

- CIR is an effective treatment at correcting or inhibiting non-load cracking and other distresses in the surface layer. The treatment consists of milling 3 to 4 inches of the existing asphalt surface layer, remixing it with an engineering emulsion or foamed asphalt, and repaving in place. Depending on the traffic levels the treatment may require a surface treatment or a thin overlay.
- Reference *SDDOT Pavement Preservation Guidelines*
- Reference Section 370 of the *SDDOT Standard Specifications for Roads and Bridges* for standards on materials and construction requirements
- CIR will be paid for at the contract price unit per square yard.

Plan / Quantity Clarifications

Salvage Depth of Surfacing Materials

- Assume the bottom 1" of surfacing or base course being salvaged is contaminated from the underlying subgrade. Do NOT add this into the quantity of salvaged material calculations, the bottom 1" would be waste material.
- If subbase is directly above subgrade, assume the bottom 2" are contaminated & considered waste material.

Section Method Plans - Section B / Section F – when salvaging pavement and/or base/subbase material:

- The quantities and plan notes for salvaging or hauling and stockpiling items will be included in Section B.
- The quantities and plan notes for any bid items involving blending and/or reusing of the material will be included in Section F.

Shoulder Widening Projects – According to Road Design guidance and to stay consistent with the practices outlined above:

- A quantity of Remove Asphalt Concrete Pavement or Remove Concrete Pavement will be added to the plans and used for the removal of this material outside the vertical cut line IF a true quantity can be measured (greater than or equal to 1 horizontal foot).
- This removal quantity will be labeled accordingly in the in-place typical sections.
- If the removal of pavement is less than 1', it will all be considered as Unclassified Excavation and labeled accordingly.
- In-place typical surfacing sections will only label salvaging or removal of existing surfacing material.
- Any undercut or additional Unclassified Excavation of material other than surfacing material will be shown and/or explained with the plan notes and the typical grading sections (in Section B if a section method set of plans is used). The sections will be hatched according to the guidance outlined above.

Unclassified Excavation, Digouts – Standard rates included for two-lane grading, shoulder widening or mill and asphalt concrete resurfacing projects. Digout rates will be verified in the Materials Recommendations Letter provided by the Surfacing Design Engineer.

- Include these quantities per mile for the removal of asphalt concrete and unstable material throughout the project:
 - Include 50 yd³ of Unclassified Excavation, Digouts
 - Include 75 yd³ of Remove Asphalt Concrete Pavement
 - Digout standard rates for asphalt shoulders outside of a concrete mainline will be ½ of what is required for two-lane asphalt surfacing or resurfacing projects.
- Include these quantities per mile for the backfill of Unclassified Excavation, Digouts throughout the project:
 - Include 100 tons of Base Course or Base Course, Salvaged
 - Include 25 tons of Asphalt Concrete (asphalt concrete type will match mainline mix or in some cases may be Asphalt Concrete Composite)
 - Digout standard rates for asphalt shoulders outside of a concrete mainline will be ½ of what is required for two-lane asphalt surfacing or resurfacing projects.

SURFACING METHODS

This chapter discusses three types of surfacing in detail, Concrete (PCC) Pavement, Asphalt Concrete (AC) Pavement, and granular or Gravel Surfacing. The type of surfacing is selected by the Office of Materials & Surfacing. See Chapter 3 – DESIGN PROCESS.

RIGID - Concrete, PCC

Rigid pavement is constructed with Portland Cement Concrete (PCC). Due to the potential for water infiltration at the joints, a foundation course, and a means of draining the foundation course may be included in the design of a rigid pavement.

Guidelines / Standard Practice

- Reference Section 380 of the *SDDOT Standard Specifications for Roads and Bridges* for detailed standards on materials and construction requirements.
- Reference Special Provisions at the end of this chapter.
- Pavement thickness will be recommended by the Office of Materials & Surfacing, but the general minimum thickness of PCC pavement on the State Highway System will be as follows:
 - 8" for mainline PCC when placement is not a PCC overlay
- Rigid pavements will be plain jointed PCC (JPCP) with epoxy coated dowel bars included at transverse joints.
- All joints require a joint sealant, see more detailed information in the section below.
- The desirable ratio for transverse joints spacing is 1.25:1 (length:width) with 1.5:1 being the maximum ratio. Please see jointing section below for an understanding of the types of joints and their purpose. Specific projects may suggest a deviation from these standards, the SDDOT encourages thoughtful project specific designs and suggestions from designers.
- Installing edge drains should be considered when installing new PCC or overlaying PCC with asphalt concrete as determined by the Materials and Surfacing Office. See more information on edge drains in the Surfacing Drainage section below.
- Curing compound should be used, see more detailed information in the section below.

Jointing – The need for a jointing system in concrete pavements comes from the desire to control the location of transverse and longitudinal cracking. Concrete cracking can occur because of shrinkage due to temperature change, loss of water, subgrade inconsistency, subbase/base course restraint, curling and warping, or improper jointing.

PCC pavement requires the following types of joints to control cracking from the stresses induced by volume changes in concrete:

- Contraction joints are in the pavement to relieve stresses caused by shrinkage, thermal contraction, and moisture or thermal gradients. Joint spacing generally divides the pavement into sections of approximately the same length and width. Longitudinal contraction joints are normally located between traffic lanes. Transverse contraction joints are located perpendicular to the centerline and will include load transfer devices across the joint. Transverse contraction joint spacing is recommended by the Surfacing Design Engineer within the Office of Materials and Surfacing.

- Expansion or isolation joints are used primarily to provide separation between the pavement and other structures such as bridges and inlets or at other pavement sections such as pavement slabs at intersections.
 - The standard is to use the 3" Membrane Sealant Expansion Joint at bridges but can vary from 2" to 5" depending on the situation and design.
- Construction joints will be placed at the end of each day's work or whenever the paving operation ceases for over 30 minutes. Construction joint location will be determined in the field, but longitudinal construction joints should be considered during the design of a project, especially when a project is being built in phases.

Several items should be considered when creating a jointing plan for a concrete pavement.

- Climate and Environmental Conditions – depending upon temperature and moisture changes that occur at the time of construction, expansion and contraction of the slab will occur.
- Slab Thickness – pavement thickness counteracts curling stresses and deflections. Thicker pavements are less prone to curling.
- Traffic – speed of traffic is an extremely important consideration in joint design. The higher the speeds, the more concern for joint curling/warping which can influence ride quality and long-term performance. The amount of truck traffic can also affect this.
- Coarse Aggregate – in South Dakota, the coarse aggregate comes into play in transverse joint spacing.
 - Limestone Aggregate
 - Quartzite or Granite Aggregate
- Whenever possible, joints in the pavement should match the pavement markings which aids in nighttime driving/or wet conditions when the pavement markings are faint. In order to have consistency between typical sections, pavement markings and joint layouts, coordination needs to occur between the grading designer, the pavement markings designer and the surfacing designer.

Load transfer devices (smooth, epoxy-coated, steel dowel bars) are used at transverse joints to transfer the load across the joints; these devices, by design, offer little resistance to longitudinal movement at the joint.

Tie bars (deformed reinforcing steel) are used to hold the faces of adjacent slabs in firm contact with one another and are not designed to act as load transfer devices.

Joint Type	Connection Type
Contraction	Dowel Bar
Expansion	Dowel Bar System or Sleeper Slab & Foam Joint
Construction	Dowel Bar or Deformed #9 Bars or 6' long #4 Bars
Tied Longitudinal Joint	Tie Bar
Untied Longitudinal Joint	Keyway

Table 19-1. PCCP Joint Types and Connections

The maximum width of concrete pavement that can be tied for longitudinal joints is 55-60 feet (engineering judgement required). Use an untied longitudinal joint (preferably at the crown point) when too many lanes are tied together. Note that the curb/gutter widths should be added in if they are also tied to the pavement. If the total width exceeds 60 feet, an untied longitudinal joint will be required.

When a project includes new concrete pavement to be placed adjacent to existing concrete pavement it will be necessary to install tie bars on the longitudinal joints. These tie bars will be a separate bid item and will be paid for as 'Insert Steel Bar'.

Dowel bars are required when joining new pavement to existing pavement at a transverse joint.

Reference Standard Plate Section 380 for joint details. Figure 19-1 shows how different joints are represented on plan sets.

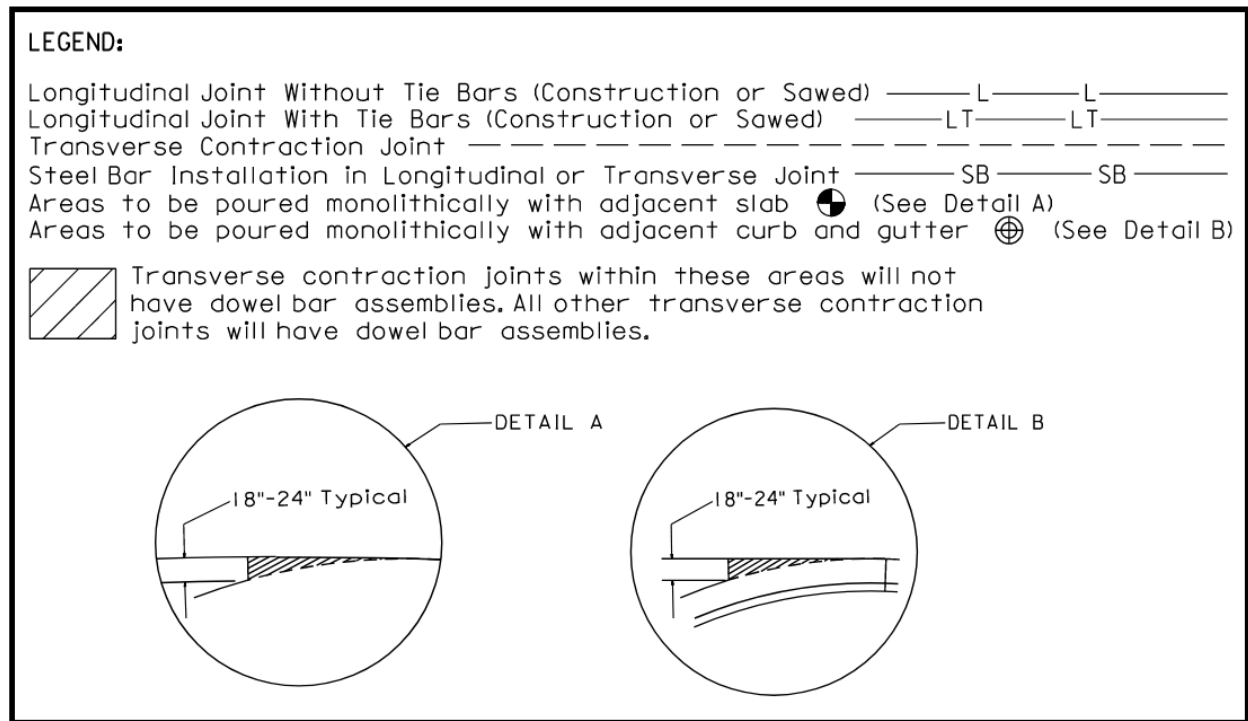


Figure 19-1. PCCP Joint Layout Legend

Joint Sealant – reference Section 870 of the *SDDOT Standard Specifications for Roads and Bridges* for the material specifications, and Section 380 for construction.

- High speed / Rural situations
 - Low Modulus Silicone Sealant in transverse joints
 - Hot Poured Elastic Joint Sealer in longitudinal joints
- Low speed / Urban situations
 - Hot Poured Elastic Joint Sealer in all joints
- PCCP Repair projects
 - Hot Poured Elastic Joint Sealer in all joints

Curing Compounds - reference Section 821 of the *SDDOT Standard Specifications for Roads and Bridges* for the material specifications, and Section 380 for construction.

- Curing Blankets
- Polyethylene Sheeting
- Liquid Membrane Forming Compounds for Curing Concrete
 - High solids white pigmented Poly-Alpha Methylstyrene (AMS) Membrane Curing Compound – this is typically used on rural PCC paving projects.
 - Linseed Oil Base Emulsion Compound – this is typically used on urban PCC paving projects.

Reference Chapter 7 – CROSS SECTIONS for standards on lane & shoulder widths, cross slopes, and the use of rumble strips for PCCP mainline surfacing. Also see Figure 19-4 for Typical Surfacing Sections.

FLEXIBLE - Asphalt Concrete

Flexible pavement is characterized by an asphaltic structure which depends on aggregate durability and gradation, air voids, binder content, and angularity for strength, cohesion, and stability.

A key difference between FLEXIBLE and RIGID pavements is the way that they transfer loading to the subgrade. A flexible pavement structure takes on more concentrated stresses under applied traffic loadings, causing it to bend, or flex. The stiffness of a rigid pavement structure causes the slab to take on more of the applied loads, which creates a wider distribution of stresses from applied traffic loadings to the underlying subgrade.



Guidelines / Standard Practice

- Reference Section 320 of the *SDDOT Standard Specifications for Roads and Bridges* for detailed standards on materials and construction requirements.
- Asphalt concrete surfacing is often used for approaches & field entrances, the standard minimum section for these applications is 3" asphalt concrete over 4" Base Course or Base Course, Salvaged.
- Asphalt concrete surfacing is often needed to tie into intersecting county roads with asphalt concrete surfacing, the standard minimum section for these applications is 4" asphalt concrete over 8" Base Course or Base Course, Salvaged.
- Reference the *Local Roads Plan* for minimum asphalt concrete surfacing sections for rural roads.

Reference Standard Plate Section 320 for asphalt concrete surfacing details.

Reference Chapter 7 – CROSS SECTIONS for standards on lane & shoulder widths, cross slopes, and the use of rumble strips for asphalt concrete mainline surfacing. Also see Figure 19-3 for Typical Surfacing Sections.

Asphalt Concrete Mix Types – Asphalt Concrete Mix will be recommended by the Surfacing Design Engineer. The following mix types are described in more detail in Section 320 through 326 of the *SDDOT Standard Specifications for Roads and Bridges*.

- Class Q, QR – reference Section 320, 322
 - Minimum of 5,000 tons of specified density mix
 - Not typically used on shoulder widening projects

- Class D, E, G – reference Section 321
 - 1,500 to 5,000 tons of specified density mix
 - Typically used on shoulder widening and smaller types of projects with no RAP available
- Asphalt Concrete Composite – reference Section 324
 - Typically used on smaller projects with less than 1,500 tons of asphalt mix
- Class S – reference Section 325
 - Used as a wearing course only
 - Typically used on higher volume facilities as well as most interstate and divided highways
- Class HR – reference Section 326
 - RAP required
 - typically has a higher RAP content than the standard 20% used on a QR project
 - frequently used on shoulders next to PCC and lower volume routes

Asphalt Binder Types – performance graded asphalt binder is more thoroughly described in Section 890 of the *SDDOT Standard Specifications for Roads and Bridges*. Listed below are some commonly used binder types for State projects. Binder rates and type, and RAP percentage are determined by the Office of Materials and Surfacing.

- PG 64-34 – typically used with new construction, and no RAP in the mix
- PG 58-34 – typically used when RAP is used in the mix, although RAP is not required to use this binder type. This is also commonly used on shoulder widening or shoulder asphalt concrete paving projects.

Application Rates – application rates can vary for asphalt emulsion and sand, which can be used during new asphalt concrete construction or existing asphalt concrete pavement rehabilitation. Below are some application rates for common situations. Rates may vary depending on project specific materials and designs.

- Prime Coat – applied on a granular surface before asphalt concrete placement
 - Application rate of 0.30 gal/yd²
 - Application width – bottom pavement width plus 1 foot per side
- Tack Coat – applied before each asphalt concrete lift
 - Application rate of 0.09 gal/yd² on aged, existing pavement or milled asphalt concrete surfaces
 - Application rate of 0.06 gal/yd² on primed base course or new asphalt concrete pavement
 - Application rate of 0.07 gal/yd² on PCCP prior to an asphalt concrete overlay
 - Application width – bottom pavement width plus ½ foot per side

- Flush Seal
 - Typically done within 10 working days following completion of the asphalt concrete surfacing.
 - Application rate of 0.05 gal/yd²
 - Application width – pavement width – all new asphalt surfaces will be flushed full width EXCEPT Class S asphalt concrete mix. There is more oil in the Class S mix, so only rumble stripes will need flush sealing for Class S. (see below)
 - Rumble Stripes (Centerline, Edge Line and Transverse) - flush seal is applied after rumble stripes have been installed.
 - Application Rate
 - All Asphalt Concrete Mixes OTHER than Class S
 - Centerline – 0.10 gal/yd²
 - Edge Line and Transverse – 0.05 gal/yd²
 - Class S Asphalt Concrete Mix
 - Centerline – 0.05 gal/yd²
 - Edge Line and Transverse – 0.05 gal/yd²
 - Application width – at least ½ foot wider than the total width of the rumble stripe
- Sand
 - Blotting Sand for Prime – can be accomplished by broom sweeping or with a mechanical spreader. Application by hand is permitted on odd shaped or inaccessible areas.
 - Application Rate – 10 lbs/yd²
 - Blotting Sand for Flush Seal – spread uniformly immediately behind the asphalt distributor. Sand will be placed by a self-powered aggregate spreader. Rolling will not be required.
 - Application will be placed 11 ft wide in each lane, leaving 12 inches on centerline and 6 inches on each edge line free of sand.
 - Application Rate – 8 lbs/yd²
 - Loose sand material remaining on the surface will be lightly broomed off after a waiting period of twenty-four hours from the time of application.

Bidding / Alternate Bidding – Different aggregate types and sources exist across the State and Region. When a surfacing/resurfacing project exists in a location where a majority of the aggregate in the asphalt mix has the potential to either consist of limestone or another type (granite, quartzite, natural, etc.), alternate bids will be set up for the asphalt mix and related items. Limestone aggregate will not absorb as much asphalt binder as the other aggregate types. This difference in absorption rate requires a different rate of asphalt binder in the mix design which requires different quantities to make up each ton of asphalt mix. Alternate rates and plan notes will be required. Locations requiring alternate bids will be determined by the Asphalt Mix Design Engineer.

Construction

- Leveling Lifts – a leveling lift can be put down prior to the mainline asphalt concrete lift. These leveling lifts are meant to fill in low spots in the existing surface to create a uniform, level surface for the first mainline lift of asphalt concrete pavement. They can also be used to modify cross slope and fill in surface voids.
 - See standard Section F Surfacing Notes regarding:
 - ½" Leveling Lifts and corresponding mix gradation
 - 1" Leveling Lifts and corresponding Class Q, QR, D, E, G or HR mix.
- Blade Laid Asphalt Concrete – will be placed using a motor grader blade, or a paver. The equipment should force the mixture into the cracks to adequately level and fill the cracks. This should be used when existing cracks are too large to be sawed and sealed. This is typically used after cold milling and prior to an asphalt concrete overlay to fill in cracks and level the surface.
 - See standard Section F Surfacing Notes regarding:
 - Asphalt Concrete Blade Laid mix design
 - Tack quantity calculation
- Surfacing Transitions – when transitioning from an asphalt concrete overlay to existing pavement, the following guidelines should be used:
 - On roadways with speed limit less than or equal to 65mph, the transition length should be 40' per inch of elevation change
 - On roadways with speed limit greater than 65mph, the transition length should be 60' per inch of elevation change
 - See Figures 19-2a and 19-2b for plan sheet examples
- Compaction of Asphalt Concrete – different mixes/classes of asphalt concrete have different requirements when it comes to compaction during construction. Table 19-2 describes when compaction to a specified density is required.

Asphalt Concrete Mix / Class	Compaction with Specified Density Required	Compaction without Specified Density
Class D, E, G, HR	<ul style="list-style-type: none"> • Mainline – Driving Lanes • Shoulders • Ramp Detours 	<ul style="list-style-type: none"> • Miscellaneous Areas outside those requiring specified density • Leveling Lifts
Class Q and QR	<ul style="list-style-type: none"> • Mainline – Driving Lanes • Shoulders <ul style="list-style-type: none"> ○ 28' top + asphalt concrete sluff and narrower 	<ul style="list-style-type: none"> • Shoulders <ul style="list-style-type: none"> ○ Greater than 28' top • Miscellaneous Areas outside those requiring specified density • Leveling Lifts
Class S	<ul style="list-style-type: none"> • Never 	<ul style="list-style-type: none"> • Always
Asphalt Concrete Composite	<ul style="list-style-type: none"> • Never 	<ul style="list-style-type: none"> • Always

Table 19-2. Asphalt Concrete Compaction Requirements

Granular Bases and Surfacing

Granular material may be used to surface county roads, driveways, approaches or intersection returns, or for temporary roads or temporary access to properties during project construction. This 'granular material' can be made up of Gravel Surfacing, Gravel Surfacing, Salvaged, Base Course, Base Course, Salvaged, Gravel Cushion, Gravel Cushion, Salvaged, or Base Course, Salvaged Asphalt Mix.

Granular material is also used below pavement as Gravel Cushion or Base Course.

Guidelines / Standard Practice

- Reference Section 260 of the *SDDOT Standard Specifications for Roads and Bridges* for detailed standards on materials and construction requirements.
- Reference the *Local Roads Plan* for minimum gravel surfacing sections for rural roads.

When used below pavement with a curb and gutter section, the width of the granular material beyond the back of curb is important for construction and is based on the type of pavement going on top of it. This extra width of granular material is meant to allow space for and support the necessary construction equipment. See Figure 19-4 for Typical Surfacing Sections.

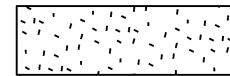
- Concrete Mainline with curb and gutter – granular material should extend 3 feet beyond the outside of the curb section
- Asphalt Concrete Mainline with curb and gutter – granular material should extend 1 foot beyond the outside of the curb section

Shaping and maintenance are extremely important when it comes to gravel roads. Reference *Gravel Roads Construction & Maintenance Guide* for more details on constructing and maintaining gravel roads.

SURFACING TRANSITION LAYOUT

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS

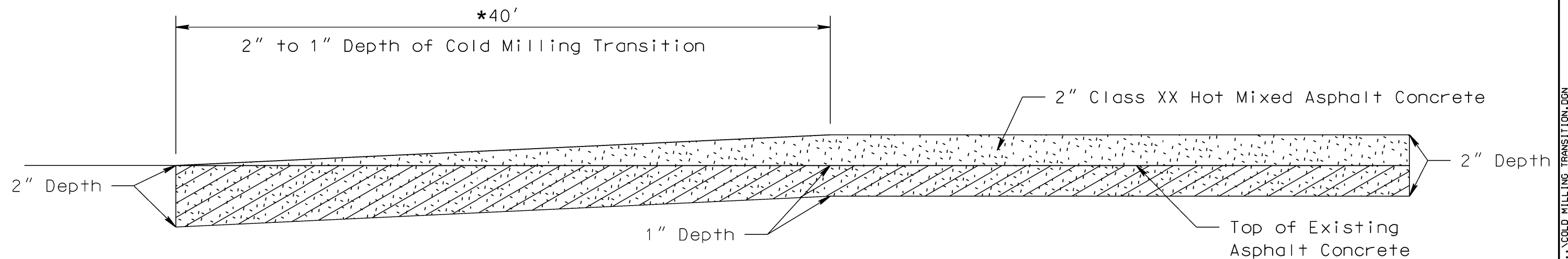
Plotting Date: 08/26/2021



2" Class XX Hot Mixed Asphalt Concrete



Cold Milling Asphalt Concrete



* ≤ 65 mph Transition length = 40' per inch of elevation change
 > 65 mph Transition length = 60' per inch of elevation change

Figure 19-2a. Surfacing Transitions (1" Mill, 2" Asphalt Concrete Overlay)


PLOT SCALE - 1:24.5703

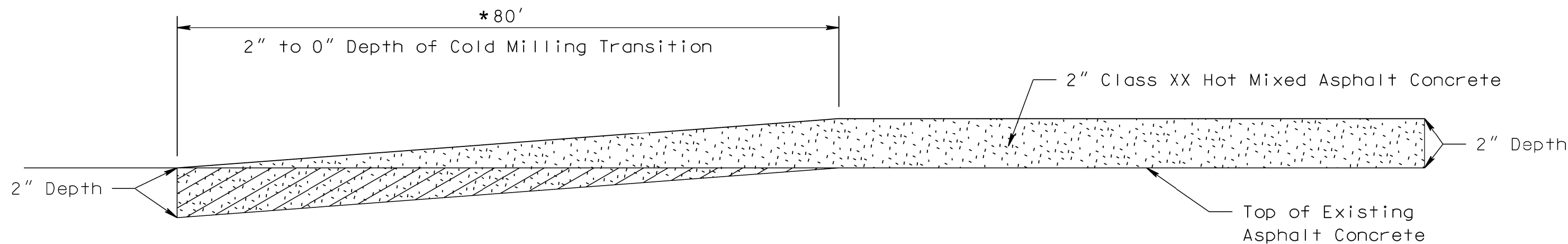
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SURFACING TRANSITION LAYOUT

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS

Plotting Date: 08/26/2021

-  2" Class XX Hot Mixed Asphalt Concrete
-  Cold Milling Asphalt Concrete



- * ≤ 65 mph Transition length = 40' per inch of elevation change
- * > 65 mph Transition length = 60' per inch of elevation change

Figure 19-2b. Surfacing Transitions (2" Asphalt Concrete Overlay)

PLOT NAME - 1

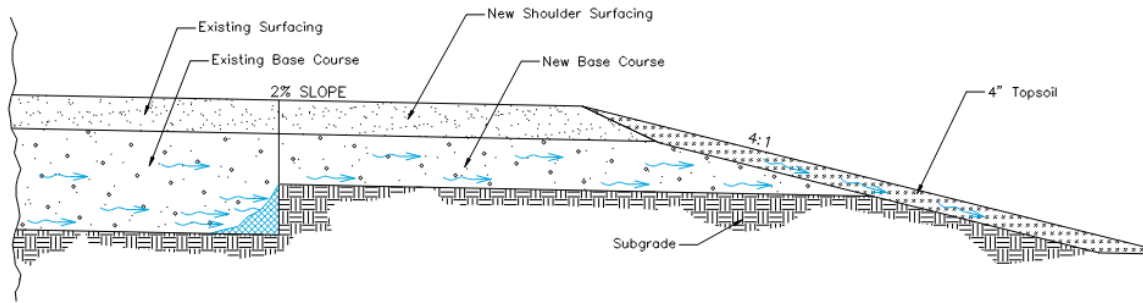
FILE - ...COLD MILLING TRANSITION.DGN

SURFACING DRAINAGE

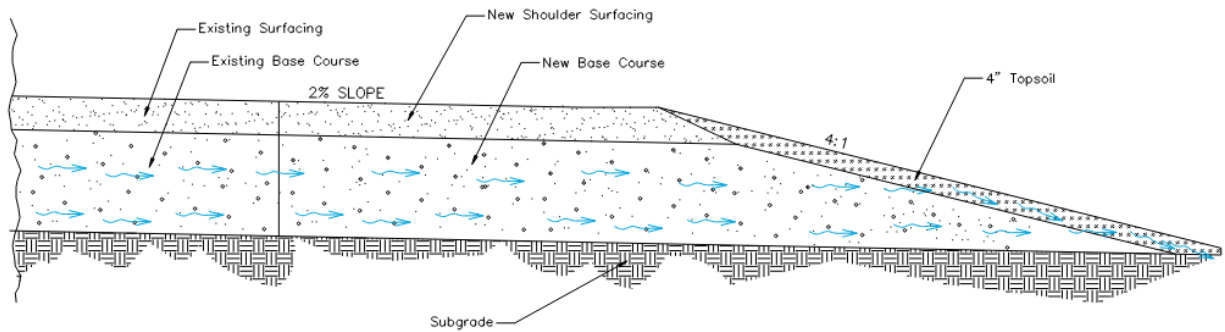
Because drainage is an important factor in pavement performance, surfacing drainage is an important consideration in pavement design.

Types of Surfacing Drainage

- Granular base materials – the ability of our granular base materials to drain is extremely important.
 - No more than 50% millings in base sections
- Adequate Cross Slope – in order to rapidly drain surface water, the shoulders should be sloped slightly steeper than the traffic lanes. Criteria to be followed are shown below:
 - Paved Shoulders normally should slope at a rate of 4%. When shoulders are used for pedestrian traffic the shoulder slopes should not exceed 2% to meet ADA guidelines. Refer to Chapter 16 – MISCELLANEOUS for ADA Guidelines.
 - Gravel Shoulders should be sloped at a rate of 4%.
 - 2% is desirable for asphalt concrete and concrete (PCC) mainline
 - 3% is desirable for granular mainline
 - Designers are able to match the existing cross slope of the in-place section on a resurfacing project
 - See Figure 19-4 for Typical Surfacing Sections
- Edge Drain – consists of a slotted pipe placed at the bottom of a trench along the edge of the roadway, which has been lined with a filter fabric and is then backfilled with granular material.
- Reference the Drainage section in *Gravel Roads Construction and Maintenance Guide* for other types of drainage options like ditches, culverts, and bridges.
- Eliminating changes in sections – With roadway widening projects, it is important to eliminate changes in surfacing depth to avoid trapping water within the granular surfacing underneath a roadway with no way out. This can be done by increasing the base under the new section of road or shoulder to ensure water flowing through the existing granular surfacing away from the centerline of the road, can continue that path. See figure below.



Blocked Subgrade Drainage



Recommended Design Sections for Positive Drainage

Figure 19-3. Design Sections - Roadway Drainage

SHOULDERS

Shoulders can be constructed with pavement or aggregate. Shoulders support the edge of the traveled portion of the roadway, provide a safe area for drivers to regain control of vehicles, and play an important part in roadway drainage, carrying water further away from the road surface. Carrying the water away from the mainline surfacing prevents saturation of the aggregate, underlying subgrade, and soil embankment and decreases the potential for swelling and unstable soils.

Guidelines / Standard Practice

- Reference Chapter 7 – CROSS SECTIONS for shoulder material, width, and slope requirements
 - Table 7-1 in Chapter 7 – CROSS SECTIONS shows information on Shoulder Width and Surfacing Standards for Construction, Reconstruction and Shoulder Widening Projects on Rural State Highways
- See Figure 19-4 for Typical Surfacing Sections
- Asphalt sluff width and slope rates
 - Maximum slope of 4:1
- Cross slopes – increased cross slope of shoulders is important for allowing water to shed away from the pavement section. In order to rapidly drain surface water, the shoulders should be sloped slightly steeper than the traffic lanes. Criteria to be followed are shown below:
 - Paved Shoulders normally should slope at a rate of 4%. When shoulders are used for pedestrian traffic the shoulder slopes should not exceed 2% to meet ADA guidelines. Refer to Chapter 16 – MISCELLANEOUS for ADA Guidelines.
 - Gravel Shoulders should be sloped at a rate of 4%.
 - Shoulder cross slope should not exceed the in-slope
- Shoulder width change
 - When changing the width of a shoulder section, the length of the taper from the narrow section to the wider section will be 50 feet per foot of change in shoulder width.

Concrete (PCC) Shoulders

PCC may be used as shoulder material for PCC mainline pavements.

- Thickness is typically the same as the PCC mainline thickness. A lesser thickness PCC shoulder may be considered for a thick PCC mainline.
- If the thickness of the PCC shoulder does not match the mainline PCC thickness, the granular base material thickness will be increased to match the mainline surfacing.
- Minimum thickness for PCC shoulder is 6".
- Rumble Strips - See Standard Plate (380.15)
- Reference *SDDOT Pavement Preservation* Figure 1-3C for shoulder pavement preservation

Asphalt Concrete Shoulders

Asphalt concrete may be used to construct shoulders adjacent to either asphalt concrete or PCC mainline pavements.

- The recommended minimum thickness for asphalt concrete shoulder is 3”.
- If widening the embankment to install guardrail, the asphalt concrete shoulder thickness may be 2”
 - Three Cable Guardrail - See Standard Plate Section 629
 - Steel Beam Guardrail - See Standard Plate Section 630
- For roadway widening, if the thickness of the asphalt concrete shoulder does not match the mainline surfacing thickness, the granular base material thickness will be increased to match the mainline surfacing.
- Rumble Strips - See Standard Plate (320.18)
- Reference *SDDOT Pavement Preservation* Figure 1-3C for shoulder pavement preservation

Granular Shoulders

Granular shoulders can be used adjacent to asphalt concrete or PCC mainline pavements.

- Gravel Surfacing is the preferred material to be used for granular shoulders. However, Base Course, Base Course, Salvaged, Gravel Cushion, Gravel Cushion, Salvaged, or Base Course, Salvaged Asphalt Concrete Mix can be used as granular material to place on the shoulder.
- Gravel Shoulders are not to be used on gradelines over 5%, adjacent to guardrail, and on superelevated curves.
- Reference *Gravel Roads Construction and Maintenance* for information about constructing and maintaining these shoulders next to gravel roads.
- Reference *SDDOT Pavement Preservation* Figure 1-3C for shoulder preservation

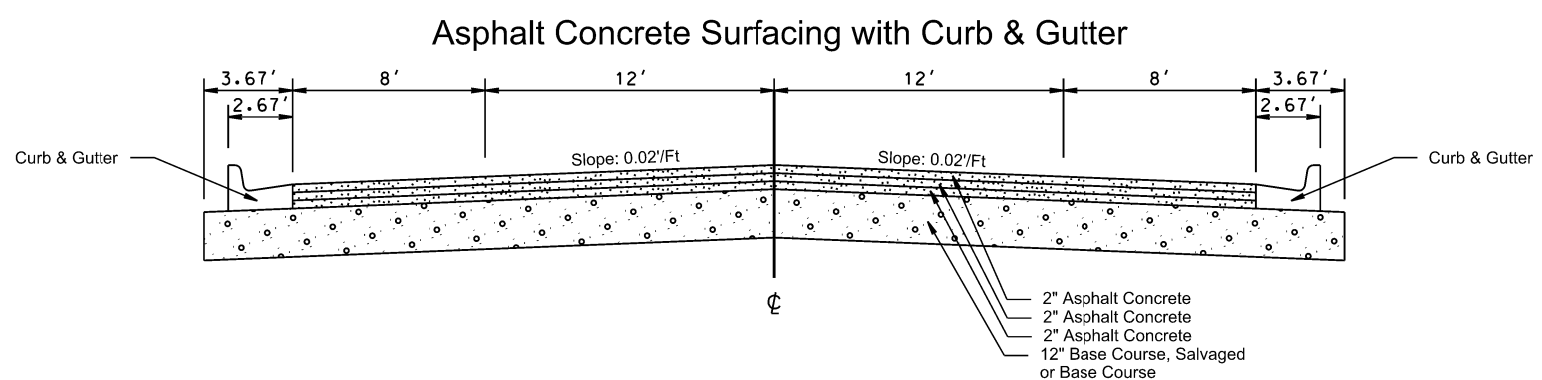
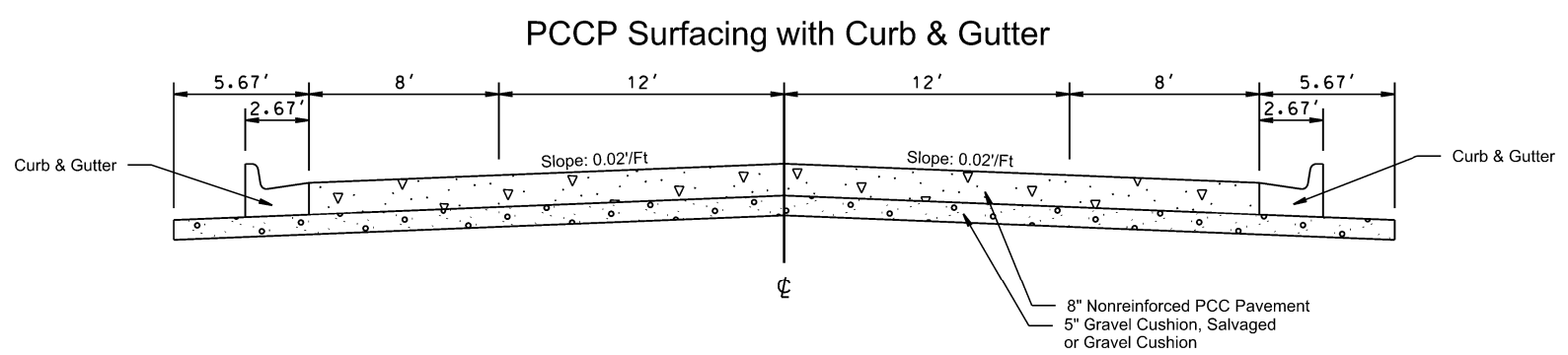
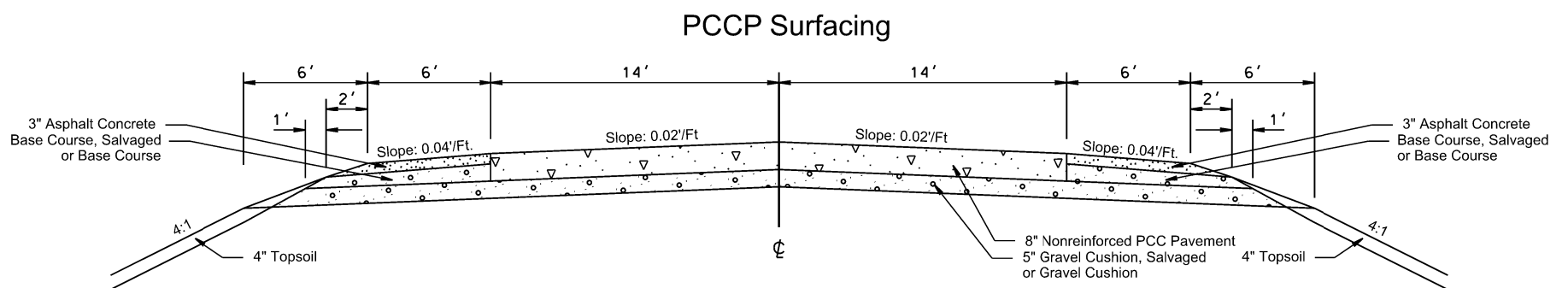
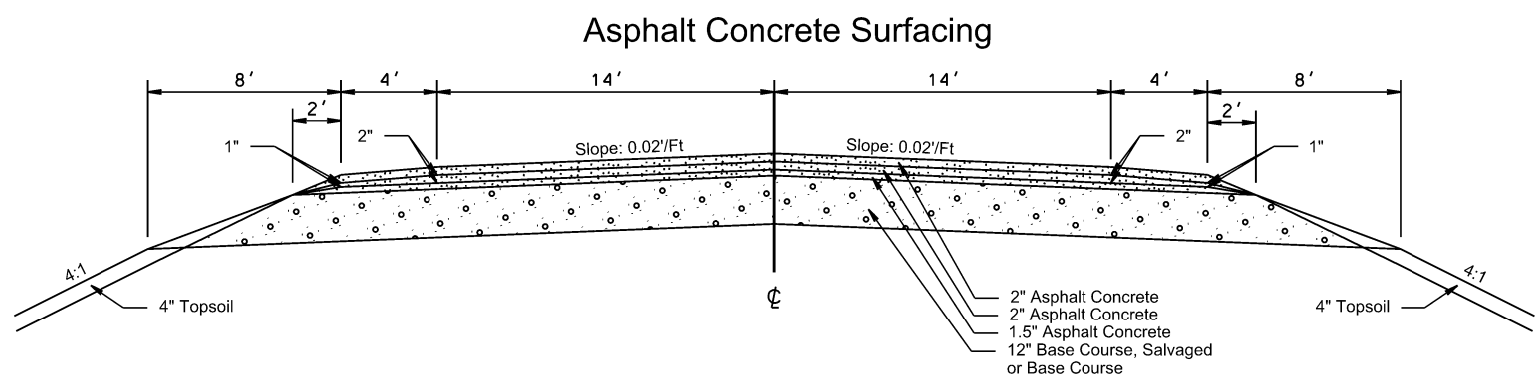
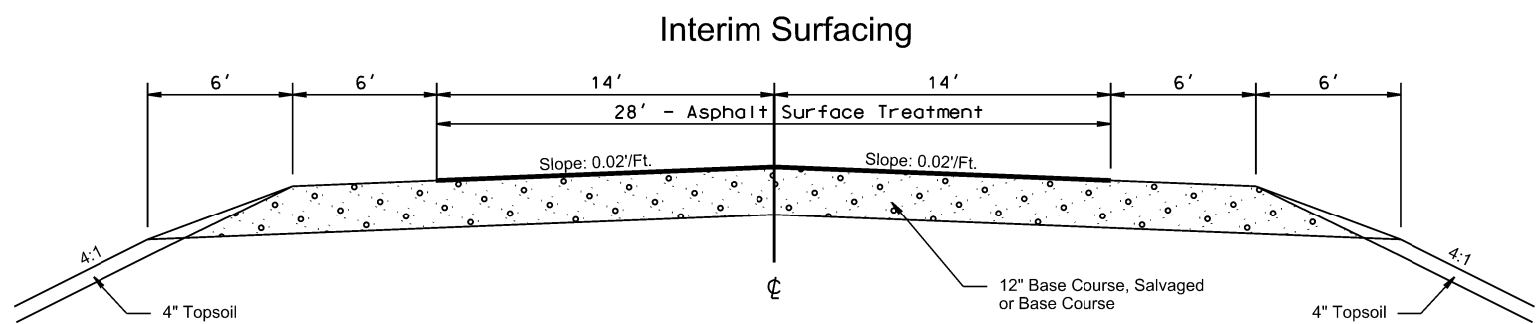


Figure 19-4. Typical Surfacing Sections

MEDIAN CROSSOVER AND RAMP DETOUR DESIGN

For interstate or divided highway projects, it is often necessary to construct median crossovers or ramp detours. Below are some general rules for design of these features.

Median Crossover Design

- 2' Undercut
- Fill area undercut and ditch with Pit Run material to a depth 20" below the top of the surfacing
- Surfacing for the median crossover (top to bottom) will be 2" Asphalt Concrete, 3" Asphalt Concrete, 3" Asphalt Concrete, 12" Base Course
- Median asphalt concrete shoulders are removed when building the crossover (median PCC shoulders will remain in place)
- Non-woven Separator Fabric is placed between the Pit Run material and the Base Course to prevent migration of fines from the Base Course into the Pit Run material
- If necessary, a pipe through the crossover may need to be included to ensure proper drainage
- Refer to Chapter 18 for plan sheet examples

Ramp Detour Design

- 1' Undercut
- Fill area undercut and ditch with Pit Run material to a depth 18" below the top of the surfacing
- Surfacing for the ramp detour (top to bottom) will be 3" Asphalt Concrete, 3" Asphalt Concrete, 12" Base Course
- Non-woven Separator Fabric is placed between the Pit Run material and the Base Course to prevent migration of fines from the Base Course into the Pit Run material
- Minimum horizontal curve radius will be 850' and the vertical alignment will be adequate for stopping sight distance
- Refer to Chapter 18 for plan sheet examples

PAVEMENT REHABILITATION/PRESERVATION

Once pavements are constructed, it is important to utilize pavement preservation techniques to ensure the intended service life of that pavement is reached. There are also a variety of pavement rehabilitation methods that can be utilized for those pavements beginning to show signs of failure, but not yet needing reconstruction.

Reference *SDDOT Pavement Preservation Guidelines* for more details on treatment types, selection, and frequency. This section of this Surfacing Chapter is here to discuss guidelines and standard practices that are not specifically covered in the Preservation Guidelines.

Refer to SDDOT Policy, *Definition and Standards for Construction/Reconstruction, Resurfacing, Restoration and Rehabilitation of Highways and Bridges under State Jurisdiction* for final surfacing widths. Projects meeting requirements may be able to utilize modified standards.

Asphalt Surface Treatments (Chip Seals)

The design will include the following information:

- Cover Aggregate Type
 - Reference Section 881 of the *SDDOT Standard Specifications for Roads and Bridges* – Type 1, 2 or 3
 - Aggregate rate of application
 - Asphalt type and rate of application
 - Type 1 and 2 Aggregate – Chip Seals
 - Reference *Modified McLeod Design Procedure* found in Volume II of Appendix C of the *Preventative Maintenance Surface Treatments Report*.
 - Type 3 Aggregate – only used for interim surfacing – Blotter Material

Full Depth Reclamation (FDR) and **Cold In Place Recycling (CIR)** are often used in rehabilitation and preservation projects. See previous section of this chapter, **Existing Materials – Removals and Salvaging**, for more information on these processes.

Mill and Asphalt Concrete Resurfacing is the most typical type of rehabilitation project used on existing asphalt concrete roadways. See previous sections of this chapter, **Definitions** and **Existing Materials – Removals and Salvaging**, for more information on this process.

SPECIAL PROVISIONS

The special provisions listed below are not a complete set of special provisions, but rather the typical provisions used on Surfacing or Resurfacing projects. This is not a complete list of all possible special provisions that may be needed for any specific project.

ASPHALT SURFACE TREATMENT DESIGN – Use this provision on all asphalt concrete surface treatment (any Type 1 and Type 2 cover aggregate ‘chip seal’) projects. This provision is not needed for Type 3 cover aggregate.

CONTRACTOR FURNISHED MIX DESIGNS FOR PCC PAVEMENT – use this provision when Contractor furnished mix designs are required on PCCP surfacing/resurfacing projects and the special provision is noted in the plan notes. This provision is typically only used when there are over 5,000 SY of PCC pavement on a project.

CONTRACTOR STAKING – use this provision whenever it is desirable to have all, or part of the construction staking performed by the contractor. Ensure the table of contractor staking is included in the project plans.

CRACK LEVELING – Use this provision whenever crack leveling is included in a project.

EDGE DRAINS – Use this provision whenever edge drains bid items are included in a project.

FLEXIBLE PAVEMENT SMOOTHNESS – Use this provision when AC paving is being performed and smoothness specifications are to be required. This provision is typically only used when a project length exceeds three consecutive miles. *Contact the Smoothness Engineer within the Office of Materials and Surfacing for recommendations of when to use this provision.*

HIGH FRICTION SURFACE TREATMENT – Use this provision whenever high friction surface treatment is included in a project.

IRI PCC PAVEMENT SMOOTHNESS – use this provision when rural mainline PCC paving is being performed and IRI smoothness specifications are to be required. *Contact the Concrete Engineer within the Office of Materials and Surfacing for recommendations of when to use this provision.*

IRI PCCP GRINDING WITH INCENTIVE – Use this provision when grinding is being performed on a longer, rural, high speed (greater than or equal to 45 MPH) doweled pavement and it is desirable to have the pavement meet a certain smoothness specification with incentive payment to the Contractor (other than those specified in Section 380.3 O.2). Call out by plan note areas that have excessive bumps (300+ IRI over 50’ increments – data typically gathered from PathWeb). Must also list Special Provision for IRI PCC Pavement Smoothness on the checklist. This provision is typically only added on rehabilitation type projects. Most grinding projects will use this special provision.

IRI PCCP GRINDING WITHOUT INCENTIVE – Use this provision when grinding is being performed on a longer, rural, high speed (greater than or equal to 45 MPH) non-doweled pavement and it is desirable to have the pavement meet a certain smoothness specification without incentive payment to the Contractor (other than those specified in Section 380.3 O.2). Must also list Special Provision for IRI PCC Pavement Smoothness on the checklist. This provision is typically only added on rehabilitation type projects.

MICRO-MILLING – Use this provision whenever micro-milling is included in a project.

MICROSURFACING – Use this provision whenever microsurfacing is included in a project.

NEXT GENERATION CONCRETE SURFACE – Use this provision on limestone aggregate concretes where aggregate polishing and rutting occur. It is used to limit noise and prevent polishing. *Contact the Concrete Engineer within the Office of Materials and Surfacing for recommendations of when to use this provision.*

PCC OVERLAY - This special provision should be used when the project is a PCC overlay project (PCC pavement bid items for furnish and placement and geotextile bond breaker fabric). Check 'Thin' when the overlay is considered a thin overlay (no dowel bars). Check 'Thick' when the project is considered a thick overlay (with dowel bars). Check both boxes if portions of the project fall under each category.

PCCP DOWEL BAR RETROFIT – Use this provision whenever dowel bar retrofit is included in a project.

PI PCC PAVEMENT SMOOTHNESS (0.2" BLANKING BAND) – use this provision when PCC paving is being performed and smoothness specifications are to be required for high-speed urban construction or longer transition speeds from 45 mph to 65 mph (other than those specified in Section 380.3 O.2). *Contact the Concrete Engineer within the Office of Materials and Surfacing for recommendations of when to use this provision.* Check 'Overlay' when the project is a PCC overlay project (PCC pavement bid items for furnish and placement and geotextile bond breaker fabric). Check 'Non-Overlay' for projects not considered PCC overlay projects (single square yard PCC pavement bid item). Check both boxes if portions of the project fall under each category.

PI PCCP GRINDING WITH INCENTIVE – Use this provision when grinding is being performed on a shorter, urban, low speed (less than 45 MPH) doweled pavement and it is desirable to have the pavement meet a certain smoothness specification with incentive payment to the Contractor (other than those specified in Section 380.3 O.2). This provision is typically only added on rehabilitation type projects.

PI PCCP GRINDING WITHOUT INCENTIVE – Use this provision when grinding is being performed on a shorter, urban, low speed (less than 45 MPH) non-doweled pavement and it is desirable to have the pavement meet a certain smoothness specification without incentive payment to the Contractor (other than those specified in Section 380.3 O.2). This provision is typically only added on rehabilitation type projects.

PORTLAND CEMENT – use this provision on all projects with concrete and concrete pavement to allow the use of Portland Limestone Cement.

TIE BAR RETROFIT – Use this provision whenever tie bar retrofit is included in a project.

SURFACING QUANTITY CALCULATIONS

Conversion factors to be used

Water for Embankment – Contractor Furnished Borrow:

1 *MGal* = 1,000 *gal* 1 *gal* of water = 8.345 *lb*

Water and Granular Material:

0.012 *MGal* of water per ton of granular material (5% water)

0.0096 *MGal* of water per ton of granular material (4% water)

Granular Material and Salvage

$yd^3 \times 1.89 = \text{Tonnage of granular material}$

$1.89 \frac{\text{tons}}{yd^3}$

Roadway Shaping

Ordinary Roadway shaping = 1.265 x width of top of subgrade = *MGal/Mile*

Heavy Roadway shaping = 2.530 x width of top of subgrade = *MGal/Mile*

Salvage PCC

$118 \frac{lb}{ft^3}$

Asphalt Concrete Density

Asphalt Concrete = 148 *lb/ft³* (Natural Aggregate, Quartzite, Ledgerock, Granite)

Asphalt Concrete = 152 *lb/ft³* (Limestone)

Asphalt

Tack and Flush – 8.5 *lbs/gal*

Prime – 7.9 *lbs/gal*

DESIGN STANDARDS / REFERENCE

SDDOT Webpage (dot.sd.gov) – Doing Business Tab

- Engineering/Design Services - Downloadable Files
 - *Plan Notes – Section F – Surfacing Notes*
- Engineering/Design Services - Manuals
 - *Road Design Manual – Chapters 2, 7*
- Engineering/Design Services - *Standard Plates*
- Engineering/Design Services - *Standard Bid Items*
- Contractors – Standard Specifications
 - *SDDOT Standard Specifications for Roads and Bridges*
- Local Governments – Forms & Documents - Publications
 - *Local Roads Plan*

FHWA - *Gravel Roads Construction & Maintenance Guide*

SDDOT Pavement Preservation Guidelines

Asphalt Surface Treatment Design (Chip Seal)

Design Standards - Interstate Crossroads

Preventative Maintenance Surface Treatments Report

SDDOT Policy DOT-P&E-PD-6.0 - Definition and Standards for Construction/Reconstruction, Resurfacing, Restoration and Rehabilitation of Highways and Bridges under State Jurisdiction